

# Monterey Bay National Marine Sanctuary

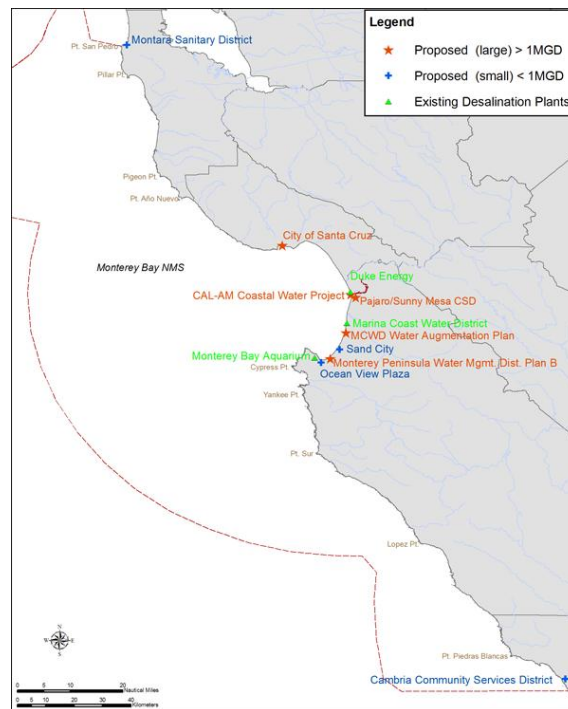
## Impacts of Desalination on Coastal Ecosystems

### Management Issue

A better understanding of the long-term ecological impacts of desalination intake methods and discharged brine will allow managers to adequately protect Monterey Bay National Marine Sanctuary (MBNMS or Sanctuary) ecosystems from threats associated with planned desalination plants.

### Description

Desalination is the process by which salts and other chemicals are removed from salt or brackish water and other impaired water resources. It is also known as desalinization or desalting or commonly referred to as “desal.” Without careful planning and mitigation measures, desalination plants have the potential to harm the marine environment through the introduction of brine effluent and other substances to MBNMS waters. Construction of desalination facilities and associated pipelines often causes alteration of the seabed. Intake of water directly from the ocean typically results in biological impacts as a result of impingement and entrainment. Impingement is when larval and adult forms of marine invertebrates and fishes collide with screens at the intake, and entrainment is when species are taken into the plant with the feed water and are killed during plant processes. There has recently been an increase in interest for both private and public desalination plants in Central California. At least ten facilities in the Sanctuary region have recently been proposed and are in some stage of initial consideration or planning. Due to population growth in the area, continuing shortages and degradation of conventional water supplies, and advances in desalination technology, this trend will likely continue. Environmental impacts of desalination facilities in large part depend on specific physical and biological conditions in the vicinity of the facility, especially the areas of intake and outfall. However, the precautionary approach currently being taken by MBNMS can be strengthened by a review of the cumulative impacts that desalination plants of different sizes have had on coastal ecosystems in other parts of the world.



*The location of existing and proposed desalination plants in the Monterey Bay National Marine Sanctuary. Map credit: MBNMS.*

### Questions and Information Needs

- 1) How can mortality due to impingement and entrainment affect biological productivity of the affected ecosystem(s), and how can impingement and entrainment be minimized?
- 2) To what extent can the decomposition of impinged and entrained organisms disposed of in the marine environment alter the oxygen content of the water near the discharge point?
- 3) What are the synergistic effects of mixing desalination brine with effluent from wastewater treatment facilities and power plants, and can this enhance brine dispersion?
- 4) What are the biological and ecosystem impacts of chemicals and heavy metals released as part of the brine effluent, and how can these be reduced?
- 5) How have species abundance and composition changed in areas where desalination facility outfalls are located?
- 6) What are the long-term effects of brine discharges on biological communities, particularly benthic communities?
- 7) What intake siting and outfall siting best practices have been used to minimize adverse ecosystem impacts?

### Scientific Approach and Actions

- Comprehensive review of studies of cumulative ecological impacts of existing desalination facilities
- Comparison of long-term ecological impacts of combined desalination brine and wastewater effluent discharge with separate discharge streams

*Updated: 9/5/2012*

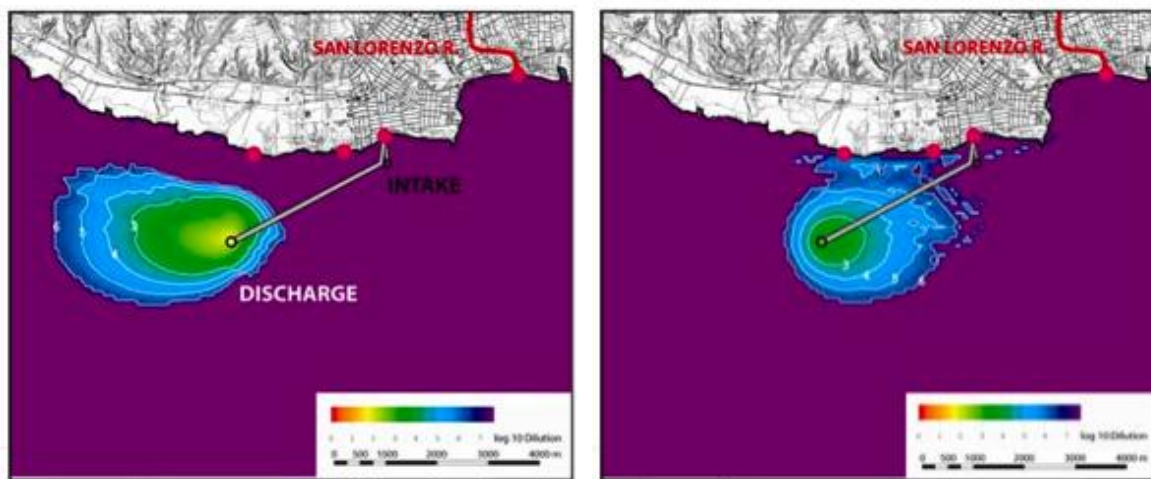
*For More Information -- <http://www.sanctuaries.noaa.gov/science/assessment>*

## Scientific Approach and Actions *(continued)*

- Identification of threats associated with chemicals and heavy metals that may be released with brine
- Description of special status species that could be affected by desalination in the MBNMS region

## Key Partners and Information Sources

Publics Works agencies, Moss Landing Marine Labs, National Marine Fisheries Service, California Coastal Commission, Southern California Coastal Water Research Project, Central Coast Regional Water Quality Control Board, State Water Resources Control Board



*Dilution and dispersion of desalination brine is influenced by ocean temperature, salinity and wave climate, and seasonal variation must be considered. A scenario for Santa Cruz desalination effluent shows dilution during the upwelling period (left) and during the relaxation period (right). Figure adapted from Jenkins and Wasyl, 2009.*

## Management Support Products

- Guidelines for effluent field monitoring programs to track pre- and post-discharge conditions
- Discharge dispersion modeling tools that incorporate regional oceanographic patterns
- List of site selection, construction, and operations best practices that can be integrated with existing MBNMS desalination guidelines to reduce ecosystem impacts

## Planned Use of Products and Actions

- New desalination plants permitted in the MBNMS will be constructed consistent with MBNMS siting guidelines to minimize impacts to the seabed
- Environmental standards for intakes and outfalls will minimize long-term ecosystem impacts
- Extensive field monitoring will occur at new desalination facilities

## Program References

### MBNMS Management Plan

- Desalination Action Plan, Strategy DESAL-2, DESAL-3, DESAL-4

### MBNMS Condition Report

- What are the levels of human activities that may influence living resource quality and how are they changing? (Nearshore Environment - Question 14)

### ONMS Performance Measures

- Number of sites in which water quality, based on long-term monitoring data, is being maintained or improved
- Number of sites in which habitat, based on long-term monitoring data, is being maintained or improved
- Number of sites in which select living marine resources (LMRs), based on long-term monitoring data, are being maintained or improved

*Updated: 9/5/2012*

*For More Information -- <http://www.sanctuaries.noaa.gov/science/assessment>*